FORM PTO-1390 (REV 12-29-99) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 1318

U.S. APPLICATION NO. (If known, see 37 CFR 1 5): 09/601905

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/SE99/00179	11 February 1999 (11.02.99)	11 February 1998 (11.02.98)

TITLE OF INVENTION: METHOD FOR EQUALIZING TEMPERATURE DIFFERENCES IN MOLTEN GLASS, AND EQUIPMENT THEREFOR

APPLICANT(S) FOR DO/EO/US: Nils LINDSKOG and Paul BUETTIKER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [X] Other items or information:
    International Search Report
    International Preliminary Examination Report
    Request for Approval of Drawing Changes

Express Mail Label No.: EK167523744US

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/601905	PCT/SE99/00179	1318

17. ☒ The following fees are submitted:

	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$970.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$840.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$690.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$670.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$96.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 970	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	11 - 20 =	0	X **$18.00**	$ 0	
Independent claims	2 - 3 =	0	X **$78.00**	$ 0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$260.00**	$ 0	
TOTAL OF ABOVE CALCULATIONS =				$ 970	
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also by filed (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$ 970	
Processing fee of **$130.00** for furnishing the English translation later than ☐20 ☐30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 970	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED =				$ 970	
				Amount to be refunded:	$
				charged:	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 501300 in the amount of $ 970.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional filing fees which may be required, or credit any overpayment to Deposit Account No. 501300. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO.

Alfred J. Mangels
4729 Cornell Road
Cincinnati, OH 45241-2433

SIGNATURE:
Alfred J. Mangels
NAME
22,605
REGISTRATION NUMBER

PATENT COOPERATION TREATY
IN THE UNITED STATES ELECTED OFFICE (EO/US)

In re application of:	]
Nils LINDSKOG et al.	]
Int'l. Appl'n. No.: PCT/SE99/00179	]
Int'l. Filing Date: 11 February 1999	] PCT DO/EO Section
Priority Date: 11 February 1998	]
For: METHOD FOR EQUALIZING TEMPERATURE DIFFERENCES IN MOLTEN GLASS, AND EQUIPMENT THEREFOR	]

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to examination, and before the calculation of the national filing fee, please amend the above-identified international application as follows:

IN THE SPECIFICATION:

Page 1, line 2, delete "herefor" and insert therefor --therefor--;

line 3, insert --BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION--;

line 11, insert --DESCRIPTION OF THE RELATED ART--;

line 16, delete "moulds" and insert therefor --molds--;

line 28, delete "metres" and insert therefor --meters--.

Page 2, line 16, after "melt" insert --,--;

line 24, after "equipment" insert --,--;

line 33, insert --SUMMARY OF THE INVENTION--.

Page 3, bridging lines 2 and 3, delete", characterized in that resistor" and insert therefor

--. Resistor--;

line 4, delete "in that";

line 7, delete ", and in that the said" and insert therefor --. The--;

line 8, delete "caused to be";

bridging lines 9 and 10, delete "caused to be".

line 13, after "invention" insert --also--; delete "an" and insert therefor

--temperature--;

bridging lines 13 and 14, delete "of the type and with the general characteristics set forth in claim 7" and insert therefor --apparatus--;

line 15, insert --BRIEF DESCRIPTION OF THE DRAWINGS--;

line 18, after "invention" insert --and--;

line 28, delete "thremocouples" and insert therefor --thermocouples--;

line 32, insert --DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

line 35, after "glass" insert --,--;

line 36, delete ", said" and insert therefor --. The--; delete "being" and insert --is--;

line 37, delete "mould" and insert therefor --mold--.

Page 4, line 4, delete "millimetres" and insert therefor --millimeters--;

line 5, delete "millimetres" and insert therefor --millimeters--;

line 7, delete "millimetres" and insert therefor --millimeters--;

line 14, after "8" insert --,--;

line 30, after "roof" insert --,--; after "respectively" insert --,--.

Page 5, line 14, delete "20, 21" and insert therefor --16, 17--;

line 27, delete "20, 21" and insert therefor --16, 17--.

Page 6, line 28, delete "control" and insert therefor --be controlled by--.

Page 7, line 34, delete "millimetres" and insert therefor --millimeters--;

line 35, delete "millimetres" (both occurrences) and insert therefor --millimeters--.

Page 8, line 5, delete "millimetres" and insert therefor --millimeters--;

line 9, delete "(oC)" and insert therefor --(°C)--;

line 17, delete "22oC" and insert therefor --23°C--;

line 27, delete "3oC" and insert therefor --4°C--.

Page 10, line 1, delete "CLAIMS" and insert therefor --What is claimed is:--.

IN THE CLAIMS:

Kindly amend the claims as follows:

1. (Amended) [Method] A method for equalizing temperature differences in molten glass in at least one temperature equalization zone that is in the form of side walls, a bottom wall, and a roof that define a channel [(1) intended] to transport a glass melt, [said] wherein the equalization zone [being] is located upstream from a tap-off point [(2)] at which the glass is tapped into a [mould] mold in a forming machine or the like, [characterized in that] said method comprising the steps of: providing resistor heating elements [(16-19; 18, 19; 24-29) are provided] in each of the temperature equalization zone side walls [(12, 13)], bottom [(14)] wall, and roof [(15), and in that] , measuring the temperatures of [the] surfaces of the respective side walls, bottom wall, and roof that are contacted by the resistor heating elements [are caused to be measured, and in that the said] , and controlling the resistor heating elements [are caused to be controlled] by an electric controller [(31-34)] so that the temperatures of said wall surfaces are [caused to be equal to or largely] substantially equal to a predetermined tapping temperature of the glass melt.

2. (Amended) [Method] A method in accordance with claim 1, [characterized in that] including the step of spacing the resistor heating elements [(16-19; 18, 19; 24-29) are spaced] at substantially regular intervals along the temperature equalization zone.

3. (Amended) [Method] A method in accordance with claim 1 [or 2, characterized in

that] , including the step of treating the temperatures of the surfaces of the respective side walls [(12, 13)], bottom [(14)] wall, and roof [(15)] that are in contact with the resistor heating elements [(16-19; 18, 19, 24-29) are caused to be measured] as the temperatures of the respective resistor heating elements.

4. (Amended) [Method as in] A method in accordance with claim 1, [2 or 3 characterized in that] including the step of forming the channel walls from a ceramic material, wherein the resistor heating elements [(16-19) comprise] include spiral elements [mounted] carried in ceramic tubes [at the] mounted on an outer surface of the ceramic material that [comprises] forms said channel walls.

5. (Amended) [Method] A method in accordance with claim 1, [2 or 3 characterized in that] including the step of forming the channel walls from a ceramic material, wherein the resistor heating elements [(18, 19; 24-29) comprise] include band-shaped resistor heating elements [which are] mounted [at the] on an outer surface of the ceramic material [(3)] that [comprises] forms said channel [(1)] walls.

6. (Amended) [Method] A method in accordance with [any of the previous claims characterized in that] claim 1, including the step of forming the temperature equalization zone [is caused] to have a length corresponding to at least 1-2 times the width of said channel [(1)].

7. (Amended) [Equipment] Apparatus for equalizing temperature differences in molten

glass in at least one temperature equalization zone that is in the form of a channel [(1) intended] to transport a glass melt, [said] wherein the equalization zone [being] is located upstream from a tap-off point [(2)] at which the glass melt is tapped into a [mould] mold in a forming machine or the like, [characterized in that] said apparatus comprising: a plurality of resistor heating elements [(16-19; 18, 19; 24-29) are provided] disposed in the temperature equalization zone side walls [(12, 13)], bottom [(14)] wall, and roof [(15)], [and in that] thermocouples [(20-23) are] provided [to measure the temperatures at] on the surfaces of the respective side walls [(12, 13)], bottom [(14)] wall, and roof [(15)] that are in contact with said resistor heating elements for measuring channel surface temperatures, and [in that] an electric controller [(31-34) is provided to control] for controlling said resistor heating elements so that the temperatures of said surfaces are [caused to be equal or largely] substantially equal to a predetermined tapping temperature of the glass melt.

8. (Amended) [Equipment] Apparatus in accordance with claim 7 [characterized in that] , wherein the resistor heating elements [(16-19; 18, 19; 24-29)] are spaced at substantially regular intervals along the temperature equalization zone.

9. (Amended) [Equipment] Apparatus in accordance with claim 7 [or 8 characterized in that] , wherein the channel walls are formed from a ceramic material, and wherein the resistor heating elements [(16-19) comprise] include spiral elements [which are mounted] carried in ceramic tubes [at the] mounted on an outer surface of the ceramic material [(3)] that [comprises] forms said channel [(1)] walls.

10. (Amended) [Equipment] Apparatus in accordance with claim 7 [or 8 characterized in that] , wherein the channel walls are formed from a ceramic material, and wherein the resistor heating elements [(18, 19; 24-29) comprise] include band-shaped resistor heating elements mounted [at the] on an outer surface of the ceramic material [(3)] that [comprises] forms said channel [(1)] walls.

11. (Amended) [Equipment] Apparatus in accordance with [claims 7-10 characterized in that] claim 7, wherein the temperature equalization zone [is caused to have] has a length corresponding to at least 1-2 times the width of said channel.

REMARKS

The foregoing specification amendments add the preferred subheadings at appropriate places within the specification, and they also correct typographical and other minor errors. None of the amendments introduces new matter because each is based upon the international application as filed.

The claims as above amended present the claimed subject matter in the U.S. claim form to more particularly point out and more distinctly claim the subject matter that the applicants regard as their invention. Additionally, the claim amendments delete multiple claim dependency.

Attached hereto is an Abstract of the Disclosure presented on a separate sheet in conformity with the rules of practice.

Based upon the foregoing specification and claim amendments to this national phase

application, it is believed that the specification conforms with U.S. formal requirements. Additionally, because the amended claims as hereinabove presented conform in substance with the corresponding claims that were examined in the international application, and based upon the acceptance by the International Preliminary Examining Authority of the invention as it was claimed in the claims that were filed in the international application as meeting each of the novelty, the inventive step, and the industrial applicability criteria set forth in the Patent Cooperation Treaty, the claims in the present application are believed to conform with both U.S. formal and substantive requirements, and they are therefore believed to be in allowable form. Accordingly, an early Notice of Allowance is in order and is respectfully solicited.

Should the examiner have any question after considering this amendment, he is cordially invited to telephone the undersigned attorney so that any such question can be quickly resolved, and in order that the present application can proceed toward allowance.

Respectfully submitted,

August 9, 2000

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Abstract of the Disclosure

A method for equalizing temperature differences in molten glass in at least one temperature equalization zone that is in the form of a channel for transporting a glass melt. The equalization zone is located upstream from a tapping point, at which the glass is tapped into a mold in a forming machine, or the like. Resistor heating elements are provided in the temperature equalization zone side walls, bottom wall, and roof. The temperatures of the surfaces of the respective side walls, bottom wall, and roof that are in contact with the resistor heating elements are measured. The resistor heating elements are controlled by an electric controller so that the temperatures of the surfaces are substantially equal to a predetermined tapping temperature of the glass melt.

Method for equalizing temperature differences in molten glass, and equipment herefor

The present invention relates to a method for equalizing temperature differences in molten glass upstream from a tap-off point at which the glass is tapped into a mould in a forming machine. Moreover, the invention relates to an equalizer, i.e. a channel in which temperature differences in the glass melt are equalized, said channel having its outlet at the tap-off point.

In the production of glass products such as glass bottles and containers of different types, it is of prime importance for the glass melt to have a predetermined and uniform weight and viscosity. If the weight and viscosity are not uniform, the yield drops sharply. This is because the moulds are not filled sufficiently, and as a result the glass bottles do not have sufficient wall thickness and do not have the necessary strength.

The glass is melted in a glass furnace from which it is transported in the liquid state via a number of transport channels. In these transport channels, attempts are made to maintain a predetermined glass temperature while keeping the temperature in the glass melt as uniform as possible. Each transport channel leads into a so-called equalizer which comprises a relatively short channel with a typical length of a few metres or so. The purpose of the equalizer is to keep the glass melt at a very uniform temperature.

The viscosity of the glass is highly dependent on temperature. Consequently, local temperature differences in the transport channel, and particularly in the equalizer, will heavily influence production yield calculated as the weight of the produced products vis-a-vis the weight of the glass melt that leaves the tap-off point.

In conventional transport channels and equalizers, a mixture of heating zones and cooling zones is used along the transport channel and equalizer. The intention is to first cool the glass to an appropriate casting temperature and then equalize the temperature in the glass melt at the predetermined casting temperature so that it is uniform throughout a cross section of the glass melt taken at right angles to the longitudinal direction of the equalizer. The cooling zones usually comprise zones where no heating takes place. Instead, the glass melt is permitted to cool down naturally. The heating zones usually incorporate heating with a gas burner, and here the flue gas sweeps along the exposed top surface of the glass melt, but resistor heating elements are also placed along the channel walls. In addition, molybdenum electrodes are inserted in the channels in such a way that the electrodes are surrounded by the glass melt and electric current flows through the glass melt between the two electrodes.

In conventional facilities, the glass melt temperature is measured at a number of discrete points in the glass melt using thermocouples. These measured values are used to control the heating equipment. Experience has shown that it does not suffice to measure the temperature at a number of discrete points and, on this basis, control the heating equipment due to the fact that there are still local temperature gradients at the outer boundary surfaces of the glass melt.

The present invention solves this problem and comprises a method and equipment that provide a significantly more uniform temperature in the glass melt than provided by conventional technology, and this in turn provides a substantial increase in yield.

The present invention thus relates to a method for equalizing temperature differences in molten glass in at least one temperature equalization zone in the form of a channel intended to transport a glass melt, said zone being located upstream

from a tap-off point at which the glass is tapped into a mould in a forming machine or the like, characterized in that resistor heating elements are provided in the temperature equalization zone walls, bottom and roof, and in that the temperatures of the surfaces of the respective walls, bottom and roof contacted by the resistor heating elements are caused to be measured, and in that the said resistor heating elements are caused to be controlled by an electric controller so that the temperatures of said surfaces are caused to be equal to or largely equal to a predetermined tapping temperature of the glass melt.

Moreover, the invention relates to an equalizer of the type and with the general characteristics set forth in claim 7.

Below, the invention is described in greater detail, partially in connection with the attached drawings which show examples of embodiments of the invention, in which:

- Fig. 1 shows a cross-section taken in the longitudinal direction of a part of a temperature equalization zone in accordance with the invention.
- Fig. 2 shows a schematic top view of a temperature equalization zone and shows the positions of the resistor heating elements.
- Fig. 3 shows a schematic cross-section taken through the temperature equalization zone.
- Fig. 4 shows the positions of the thremocouples in the channel of the temperature equalization zone.
- Fig. 5 shows a block diagram of the electric control equipment.

Fig. 1 shows a longitudinal cross-section of a temperature equalization zone intended to equalize temperature differences in molten glass in the form of a channel 1 used to transport a glass melt, said zone being located upstream from a tap-off point 2 at which the glass is tapped into a mould

(not shown) in a forming machine or the like. A cross-section of channel 1 is shown in Fig. 3. The channel is made of an appropriate ceramic material 3 such as aluminium oxide Al203. The channel can, for example, be about 1000 millimetres wide and have a depth of about 150 millimetres. For such cross-sectional dimensions, the temperature equalization zone can be about 2000 millimetres long. Above the channel there is a roof 4 made of insulating refractory material, firebrick for example.

Beneath channel 3 there is additional insulation 5 in the form of, for example, firebrick. The entire temperature equalization zone rests on supports in the form of a steel beam 6. Above roof 4 there is also additional insulation 7, 8 in the form of firebrick for example.

A stopper plug 9 is provided to prevent glass melt 11 from entering into a tapping zone 10 that includes tap-off point 2. The tapping zone is made of an appropriate ceramic material such as aluminium oxide.

In accordance with the invention, resistor heating elements are provided in the walls 12, 13, bottom 14 and roof 15 of the temperature equalization zone, see Fig. 3. In Fig. 3, numbers 16-19 represent such resistor heating elements. These are of an appropriately known type, supplied by, among others, KANTHAL AB located in Hallstahammar, Sweden.

In accordance with the invention, the temperatures of the surfaces of the walls, bottom and roof respectively that are in contact with the resistor heating elements are measured, and said resistor heating elements 16-19 are controlled by an electric controller so that said temperatures of said surfaces are caused to be kept equal or largely equal to a predetermined tapping temperature of the glass melt.

ently high power output to be able to maintain a sufficiently high and predetermined temperature in the glass melt.

In accordance with a preferred embodiment, the temperature equalization zone is caused to have a length which corresponds to at least 1-2 times the width of said channel.

An electric controller was mentioned above. A block diagram in Fig. 5 shows such a controller. Appropriately, the controller incorporates a microprocessor 31 with associated memory and software. All thermocouples are connected to the microprocessor via suitable input circuits so that the microprocessor therewith obtains a signal that corresponds to the temperature measured by the respective thermocouple. The microprocessor is designed to control, via control circuits 32-34 which include thyristors, each and every resistor heating element, exemplified as elements 16, 17, 19 in Fig. 5, either individually or in groups.

To summarize, there is thus an equalization zone that includes a large number of resistor heating elements that are regulatable so that channel 1 can be kept at a predetermined temperature.

As set forth above, the temperatures of the surfaces of the respective walls, bottom and roof contacted by the resistor heating elements are caused to be measured, and the resistor heating elements are caused to control the electric controller so that the temperatures of said surfaces are caused to be kept equal or largely equal to a predetermined tapping temperature of the glass melt.

Experience has shown that if the walls contacted by the resistor heating elements are at the temperature that was predetermined for the glass melt, the temperature gradient, after an initial warm-up period in the temperature equalization zone, through the material 3 that forms the channel will

be zero or close to zero. This means that the inner channel walls will assume the predetermined temperature of the glass melt.

When the glass melt is transported to the temperature equalization zone, it has an average temperature that is close, or very close, to the desired tapping temperature, but the temperature is unevenly distributed through a cross-section of the glass melt taken at right angles to the transport direction of the glass melt. It is this uneven temperature distribution which gives rise to the problem mentioned in the introduction.

Immediately upstream from the tap-off point there are, arranged in a known manner, usually nine thermocouples 35-43 that form a matrix 44 located in channel 1 and used to measure the temperature distribution in the glass melt. Preferably, these thermocouples 44 are connected to the microprocessor. Consequently, the microprocessor can be arranged to issue an warning signal when the temperature distribution is not sufficiently uniform.

By means of the invention, the problem mentioned in the introduction is thus solved while providing a 10-15% increase in yield, as compared with a conventional temperature equalization zone. The main difference between using the present invention and a conventional method is that for a conventional temperature equalization zone the temperature of the inner surface of the channel is lower than the desired temperature of the glass melt.

Below are some examples of a practically conducted test.

The temperature equalization zone was 2440 millimetres long. The channel was 1060 millimetres wide and 152 millimetres deep. Six bottom elements and six roof elements were spaced at regular intervals along the zone. Each element had a maxi-

mum power output of 2855 W. Six side elements were placed along the two sides of the zone and spaced at regular intervals. Each of these elements had a maximum power output of 595 W. The glass melt was transported in the channel at a speed of 10 millimetres per second.

Before the equalization zone was equipped with elements in accordance with the invention, the temperatures in said matrix 44 were as tabulated below in degrees centigrade (oC). The values set forth below are for the positions shown in Fig. 4.

1166	1169	1166
1161	1175	1161
1153	1176	1153

The greatest temperature difference was thus 22oC.

After starting to use the invention, the corresponding temperatures were as follows.

1164	1166	1166
1163	1166	1162
1163	1166	1163

As these figures show, the greatest temperature difference was only 3oC.

Several examples of embodiments have been described above. However, it is obvious that the number of elements, the type of elements, the power outputs of the elements and the locations of the elements must be adapted to the temperature equalization zone in question. An expert, however, will have no difficulty in calculating the power output and the number of resistor heating elements needed to implement the invention in an existing or recently manufactured temperature equalization zone.

The existing invention shall therefore not be considered limited to what has been set forth above. Instead, it can be varied within the scope of what is set forth in the attached claims.

Claims

1 Method for equalizing temperature differences in molten glass in at least one temperature equalization zone in the form of a channel (1) intended to transport a glass melt, said zone being located upstream from a tap-off point (2) at which the glass is tapped into a mould in a forming machine or the like, characterized in that resistor heating elements (16-19; 18, 19; 24-29) are provided in the temperature equalization zone walls (12, 13), bottom (14) and roof (15), and in that the temperatures of the surfaces of the respective walls, bottom and roof contacted by the resistor heating elements are caused to be measured, and in that the said resistor heating elements are caused to be controlled by an electric controller (31-34) so that the temperatures of said surfaces are caused to be equal to or largely equal to a predetermined tapping temperature of the glass melt.

2. Method in accordance with claim 1, characterized in that the resistor heating elements (16-19; 18, 19; 24-29) are spaced at regular intervals along the temperature equalization zone.

3. Method in accordance with claim 1 or 2, characterized in that the temperatures of the surfaces of the respective walls (12, 13), bottom (14) and roof (15) that are in contact with the resistor heating elements (16-19; 18, 19; 24-29) are caused to be measured as the temperatures of the respective resistor heating elements.

4. Method as in claim 1, 2 or 3 characterized in that resistor heating elements (16-19) comprise spiral elements mounted in ceramic tubes at the outer surface of the ceramic material that comprises said channel.

5. Method in accordance with claim 1, 2 or 3 characterized in that resistor heating elements (18, 19; 24-29) comprise

band-shaped resistor heating elements which are mounted at the outer surface of the ceramic material (3) that comprises said channel (1).

6. Method in accordance with any of the previous claims characterized in that the temperature equalization zone is caused to have a length corresponding to at least 1-2 times the width of said channel (1).

7. Equipment for equalizing temperature differences in molten glass in at least one temperature equalization zone in the form of a channel (1) intended to transport a glass melt, said zone being located upstream from a tap-off point (2) at which the glass is tapped into a mould in a forming machine or the like, characterized in that resistor heating elements (16-19; 18, 19; 24-29) are provided in the temperature equalization zone walls (12, 13), bottom (14) and roof (15), and in that thermocouples (20-23) are provided to measure the temperatures at the surfaces of the respective walls (12, 13), bottom (14) and roof (15) that are in contact with said resistor heating elements and in that an electric controller (31-34) is provided to control said resistor heating elements so that the temperatures of said surfaces are caused to be equal or largely equal to a predetermined tapping temperature of the glass melt.

8. Equipment in accordance with claim 7 characterized in that resistor heating elements (16-19; 18, 19; 24-29) are spaced at regular intervals along the temperature equalization zone.

9. Equipment in accordance with claim 7 or 8 characterized in that resistor heating elements (16-19) comprise spiral elements which are mounted in ceramic tubes at the outer surface of the ceramic material (3) that comprises said channel (1).

10. Equipment in accordance with claim 7 or 8 characterized in that resistor heating elements (18, 19; 24-29) comprise band-shaped resistor heating elements mounted at the outer surface of the ceramic material (3) that comprises said channel (1).

11. Equipment in accordance with claims 7-10 characterized in that the temperature equalization zone is caused to have a length corresponding to at least 1-2 times the width of said channel.

1318

PATENT COOPERATION TREATY
IN THE UNITED STATES ELECTED OFFICE (EO/US)

In re application of:

Nils LINDSKOG et al.

Int'l. Appl'n. No.: PCT/SE99/00179

Int'l. Filing Date: 11 February 1999

Priority Date: 11 February 1998

For: METHOD FOR EQUALIZING TEMPERATURE DIFFERENCES IN MOLTEN GLASS, AND EQUIPMENT THEREFOR

PCT DO/EO Section

REQUEST FOR APPROVAL OF DRAWING CHANGES

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Pursuant to the provisions of 37 C.F.R. § 1.123, applicants hereby request the approval of the examiner for the proposed drawing changes shown in red on the attached marked-up photocopy of Figure 2 of the drawings forming part of the above-identified application. The proposed changes involve the substitution in Figure 2 of reference numeral 16 for reference numeral 20 (five occurrences) and the substitution of reference numeral 17 for reference numeral 21 (three occurrences).

Respectfully submitted,

August 9, 2000

Alfred J. Mangels
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Cincinnati, Ohio 45141
Telephone: (513) 469-0470

Fig. 1

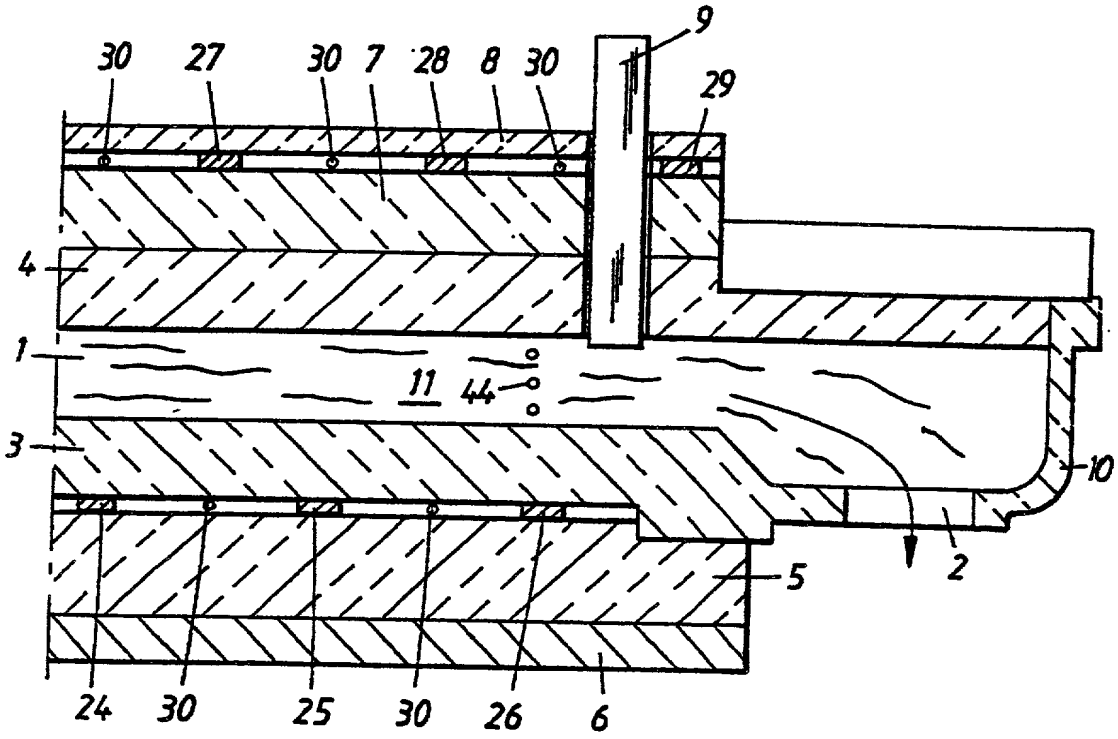
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Fig. 2

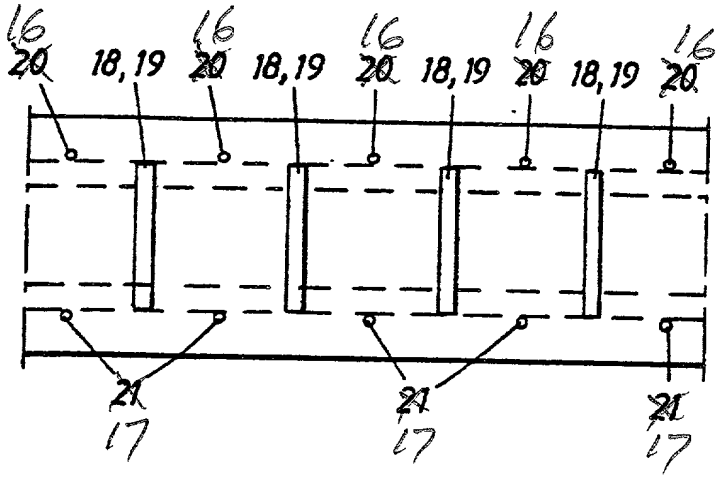
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Fig. 1

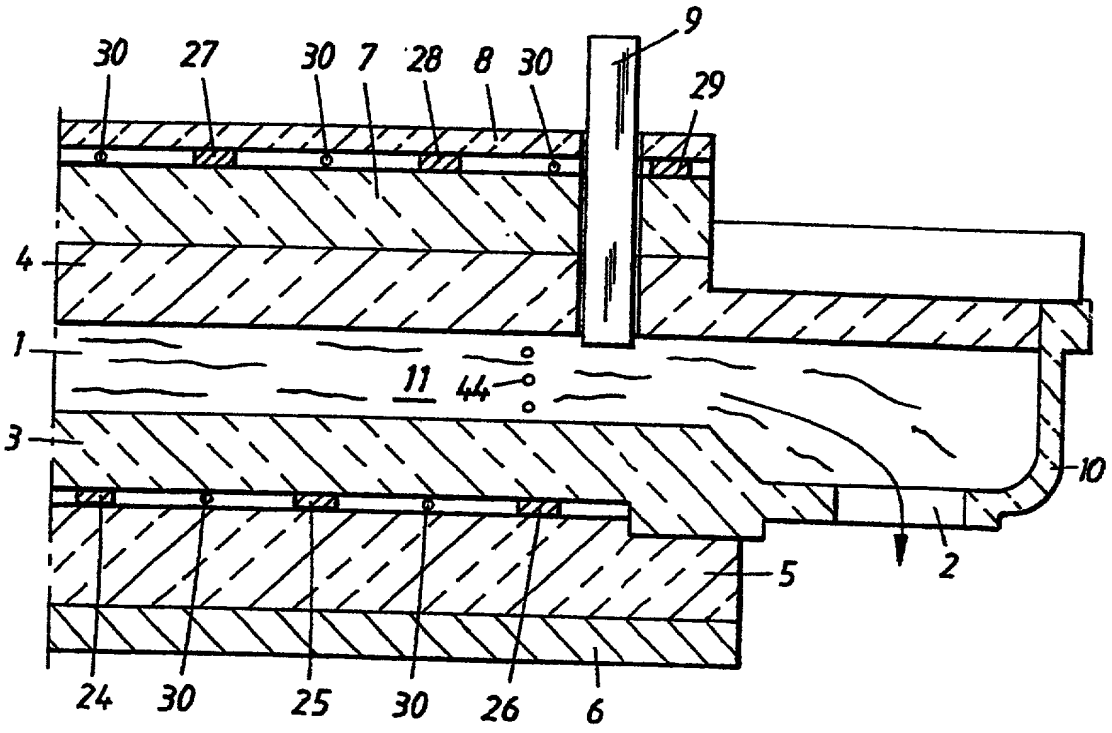
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Fig. 2

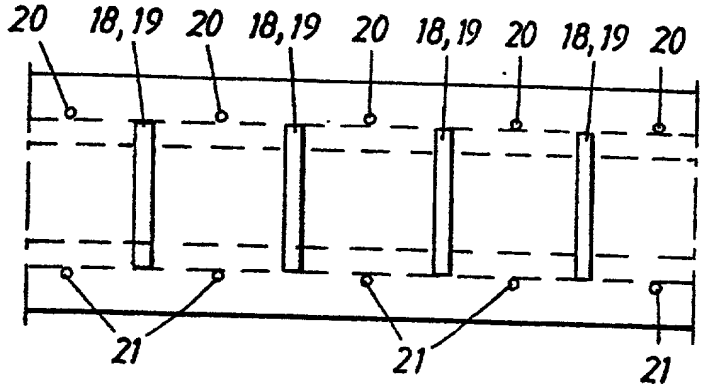
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Fig 3

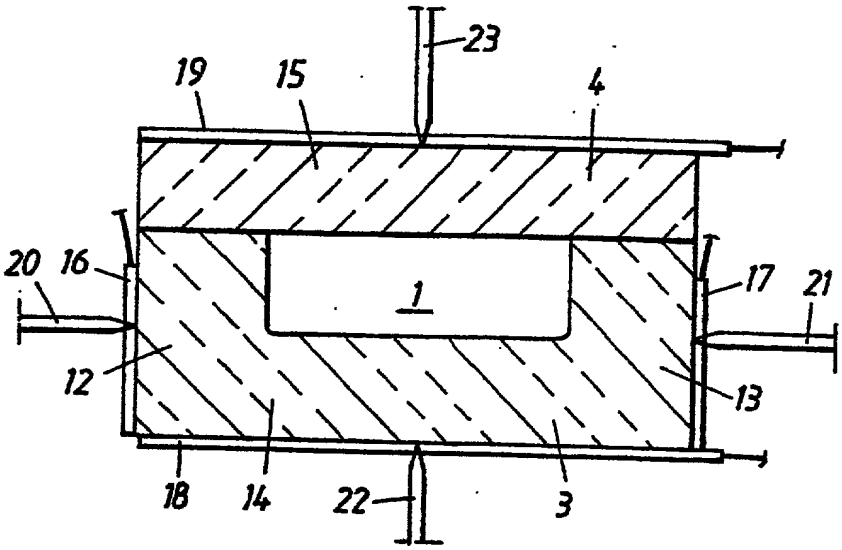


Fig 4

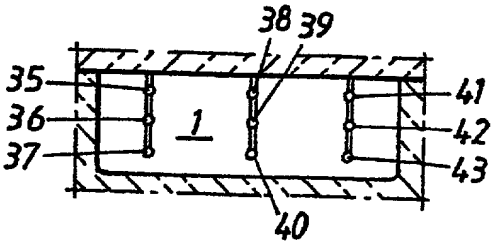
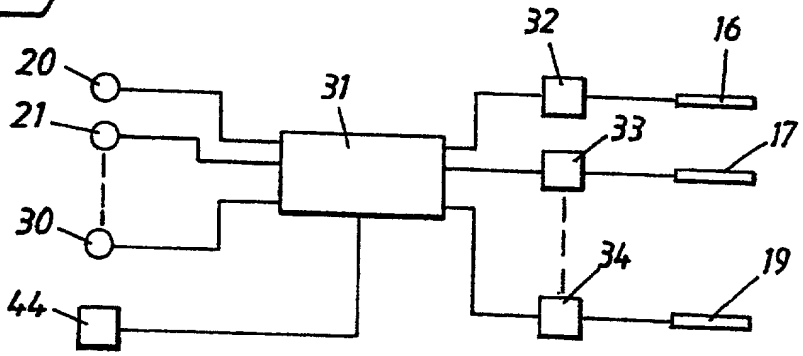


Fig 5



ATTORNEY'S DOCKET NO.
1318

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name; and
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled Method for equalizing temperature differences in molten glass, and equipment therefor.,
the specification of which

(check one) ☐ is attached hereto.
☒ was filed on August 9, 2000 as
Application Serial No. 09/601,905
and was amended on August 9, 2000 (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a), and Title 35 USC §102, as printed on the reverse of this Declaration and which I have read.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed
9800397-3 (Number)	Sweden (Country)	11 February 1998 (Day/Month/Year Filed)	☒ Yes ☐ No
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes ☐ No

POWER OF ATTORNEY: As a named inventor, I hereby appoint Alfred J. Mangels, Registration No. 22,605, my attorney with full power of substitution and revocation to prosecute this application, to receive correspondence from and transact all business in the Patent Office connected therewith. The correspondence address of the above attorney is:

SEND CORRESPONDENCE TO: Alfred J. Mangels
4729 Cornell Road
Cincinnati, Ohio 45241-2433

DIRECT TELEPHONE CALLS TO: (513) 469-0470

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Full name of sole or first inventor Nils Lindskog
Inventor's signature _____ Date 8 August 2000
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Citizenship Swedish SEX
Post Office Address Dolomitvägen 14, SE-734 37 Hallstahammar, Sweden

2-00

Full name of second joint inventor, if any Paul Buettiker
Inventor's signature _____ Date 8 August 2000
Residence Charlottesville VA.
Citizenship Swiss / USA
Post Office Address 114 Harvest Drive, Charlottesville, VA 22903, USA

Full name of third joint inventor, if any _____
Inventor's signature _____ Date _____
Residence _____
Citizenship _____
Post Office Address _____

United States Patent & Trademark Office

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Application deficiencies were found during scanning:

☑ Page(s) 5 of Specification were not present for scanning.
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